10-1976

Lower Androscoggin River

Walter A. Lawrance
Bates College

ANDROSCOGGIN RIVER STUDIES

THIRTY-FOUR YEAR

ANNUAL REPORT

1976

Part Two

Lewiston Maine
October 1976

THIRTY-FOUR YEAR ANNUAL REPORT

1976

PART TWO

LOWER ANDROSCOGGIN RIVER

LIVERMORE FALLS to LEWISTON MAINE

Biochemical Oxygen Demands, five day 20°C
Dissolved Oxygen
Benthal, Lignin, Algae
River Flows, Water Temperature, pH, Foam, Odor

INTRODUCTION River flows, Dissolved Oxygen and Biochemical Oxygen Demands entering the Pool were larger than those recorded for the 1975 season. However, the dissolved oxygen surplus was much above average. Floating solids were present but somewhat less numerous than in previous years. Gassing was very voluminous and extensive. Objectionable odors were occasionally detected in the sector, Mile 4.25 to Mile 2.5, but not in the downtown areas. Blue-Green algae were present but were not a nuisance. Gulls were catching fish in all sectors of the Pool.

Sampling stations in the area covered by Part Two of this report are:

1. Livermore Falls
2. North Turner
3. Turner Center
4. Pool, Mile 4.25
5. Pool, Mile 2.5
6. Pool, Mile 1.0
7. Gulf Island Dam
8. Deer Rips Dam
9. Lewiston Canal

Locations four, five and six were not sampled on Thursdays. Water from the other stations, except #1, was sampled and tested six days each week. River flows at stations four to nine inclusive, are considered the same as those recorded at Gulf Island Dam.

Analytical and other data are summerized and tabulated for each week and placed in the appropriate sections. The daily data for each sampling station are listed on pages located at the end of this Report.

1. Livermore Falls. Statistics for the Livermore Falls sampling station are placed in Part One of this Report. The k_1 rate for the period July 26 to August 27 as unusually high, due in part to the erratic flows during August and also due to the probability, that some water samples were not representative of the river passing Livermore Falls.

LIVERMORE FALLS - NORTH TURNER

July 26 - Aug. 27

Location	Dissolved Oxygen lbs/day	ppm	B.O.D.5 lbs/day	ppm	FLOW av.cfs	TEMP. av.°C
Liv. Falls*	219170	8.0	122020	4.3	5006	19.8
No. Turner Br.*	211500	6.9	76340	2.4	5384	20.4
Change	- 7670	-1.1	- 45680	-1.9	∔ 378	∔ 0.6

*Five day week k_1 0.57

Livermore Falls - North Turner

'Season' Aver.	k_1	B.O.D.5 lbs/day	decrease ppm	D.O. decrease lbs/day	ppm
1976	0.57	31960	1.7	9660	1.1
1975	0.40	30630	2.2	5860	0.9
1974	0.20	12810	0.8	14260	1.1
1973	0.46	55990	3.1	35990	2.0
1972	0.41	40720	2.1	15300	1.2

ANDROSCOGGIN POOL

The Androscoggin Pool is the area of river water extending from the base of the North Turner Falls to Gulf Island Dam. For analytical and statistical reasons the area downstream to Deer Rips Dam is considered to be a part of the Pool.

2. <u>North Turner</u>. The North Turner sampling station is located a few feet upstream at the top of the Falls. During the season weekly average river in-flows varied from 2897 cfs to 7519 cfs and averaged 3991 cfs. During five weeks July 26 to August 28 the average flow was 5108 cfs, one of the highest on record for that period. During Wednesday August eleven 15680 cfs was reported as passing this sampling station.

NORTH TURNER BRIDGE

Period*	Dissolved Oxygen lbs/day	Dissolved Oxygen ppm	B.O.D.5 lbs/day	B.O.D.5 ppm	D.O. Surplus+ Deficit-
May 31 to June 26	124790	6.7	48420	2.6	+ 76370
June 28 to July 24	122050	6.6	39050	2.1	+ 83000
July 26 to Aug. 28	200500	7.0	69510	2.3	+130990
Aug. 30 to Sept.11	137 270	7.5	40890	2.2	+ 96380
SEASON AVERAGE	150960	6.9	51950	2.3	+ 99010

*Six days each week

DISSOLVED OXYGEN - BIOCHEMICAL OXYGEN DEMAND

NORTH TURNER BRIDGE

(6 day)

Weekly Averages 1976

Week Beginning	FLOW cfs	TEMP. °C	pH	D.O. ppm	D.O. lbs/day	B.O.D. ppm	B.O.D. lbs/day
May 31	4180	17.4	6.8	7.9	178120	2.9	66490
June 7	3333	20.0	6.8	6.8	122280	2.1	37950
14	3031	22.1	6.7	6.2	100682	2.8	45680
21	3255	24.3	6.6	5.7	98080	2.5	43570
Average	3449	21.0	6.7	6.7	124790	2.6	48420
June 28	4142	20.8	6.7	6.8	151740	2.7	59650
July 5	3077	23.1	6.9	6.6	109270	1.9	31220
12	3542	21.9	6.9	6.9	133140	1.3	25510
19	2957	22.9	6.9	5.9	94030	2.5	39810
Average	3430	22.2	6.9	6.6	122050	2.1	39050
July 26	3725	20.8	6.9	6.7	134120	2.1	42740
Aug. 2	4669	19.1	6.8	7.2	187790	2.4	54690
9	7561	19.9	6.7	7.3	311850	3.1	147150
16	6472	20.0	6.8	7.5	263910	1.9	66340
23	3116	23.1	6.8	6.2	104830	2.2	36610
Average	5108	20.6	6.8	7.0	200500	2.3	69510
Aug. 30	3707	19.2	6.9	7.3	146550	2.3	46120
Sept. 6	3100	17.3	7.0	7.7	127990	2.1	35650
Aug. 30-Sept. 11 Average	3404	18.3	7.0	7.5	137270	2.2	40890
SEASON AVERAGE	3991	20.8	6.8	6.9	150960	2.3	51950
Sept. 13-18	3374	19.0	6.9	7.5	137380	2.9	51650
20-25	2975	18.4	6.9	6.8	109330	2.9	45890
30		13.0	6.6	8.7		3.9	

NORTH TURNER BRIDGE

'Season' Period	B.O.D.5 av.lbs/day	D.O. av.lbs/day	av.lbs/d D.O. Deficit- Surplus+
1976	51950	150960	+ 99010
1975	37900	109370	+ 71470
1974	58690	160930	+102240
1973	102190	209510	+107320
1972	81520	136310	+ 54790
1971	71410	71690	+ 270
1970	73560	69940	- 3650
1969	91500	172240	+ 80740
1968	72200	141100	+ 68900
1967	68800	91700	+ 22900
1966	46800	55800	+ 900

Pollution load average was somewhat larger than that recorded last year due, in part, to the flushing of the river during the high flows in August. Dissolved Oxygen daily average 6.8 ppm was more than adequate for the <u>ultimate</u> biochemical oxygen demand. The smallest dissolved oxygen recorded at North Turner was 5.3 ppm on June 26. This is the third year when all D.O. analyses were above five ppm. The ratios of biochemical oxygen demand (five day) to dissolved oxygen for the four periods were:

Period	B.O.D.5	D.O.	B.O.D. ult.	D.O.
May 31-June 26	1.00	3.13	1.00	2.13
June 28-July 24	1.00	2.61	1.00	1.77
July 26-August 28	1.00	2.15	1.00	1.46
August 30-Sept.11	1.00	2.80	1.00	1.90

NORTH TURNER BRIDGE

Dissolved Oxygen

	above FIVE ppm	below FOUR ppm	D.O. ppm av.
1976	90 days	0 days	6.8
1975	90 "	0 "	6.5
1974	89 "	0 "	6.9
1973	49 "	11 "	6.1
1972	85 "	0 "	6.4
1971	31 "	26 "	4.9
1970	47 "	24 "	5.2
1969	78 "	1 "	6.5
1968	47 "	20 "	5.9
1967	49 "	19 "	5.2
1966	19 "	51 "	4.0

NORTH TURNER - TURNER CENTER REACH

This reach of the Pool is 6.4 miles long and is reported to have a surface area of about 760 acres. The midstream depth varies from ten to twenty feet and in a few locations to thirty feet.

NORTH TURNER - TURNER CENTER*

July 26 - August 28

Station	Dissolved Oxygen lbs/day	Dissolved Oxygen ppm	B.O.D.5 lbs/day	B.O.D.5 ppm	TEMP. av.°C	FLOW av.cfs
N.T.B.	200500	7.0	69510	2.3	20.6	5108
T.C.B.	198980	6.2	59630	1.8	21.0	5634
Change	- 1520	-0.8	- 9880	-0.5	+ 0.4	+ 526

*Six day each week k_1 0.17

BENTHAL

The extent and depth of the benthal in this sector of the Pool is unknown. This season floating sludge, although numerous, was not as extensive as that in previous years and gassing appeared to indicate a lower benthal activity.

Due to a relatively high river velocity during August, the suspended solids leaving this area were much larger than usual.

Estimates of the benthal contribution to the pollution load are, at best, only approximate due to the many variables each of which may vary at different rates from day to day. This season erratic flows were an additional complication.

NEZINSCOT RIVER
Route 117 Bridge

Estimated daily average*

Period** Tests ()	D.O. lbs/day	B.O.D.5 lbs/day	Nezinscot (cfs) "Inflow to Pool"***
June (2)	10390	1270	241
July (5)	10540	1020	246
July 26-Aug.23 (5)	13920	1300	310
Aug.30-Sept.13 (3)	15820	1170	309

*N.T.B. minus T.C.B.
**Sampled Mondays only
***Day of sampling

Statistics are tabulated and placed at the end of this report.

Benthal B.O.D.5 Contribution (Estimated)

North Turner to Turner Center

July 26 - August 28, 1976

1. B.O.D.5 entering Pool (N.T.) lbs/d	69510
2. B.O.D.5 " " Nezinscot lbs/d	1300
3. B.O.D.5 leaving Pool (T.C.) lbs/d	59630
4. B.O.D.5 decrease (measured) " (N.T.-T.C.)	9880
5. B.O.D.5 decrease of #1 (estm.)"	14500
6. B.O.D.5 benthal (30440-24380)	6060
7. D.O. entering Pool lbs/d	200500
8. D.O. reaeration N.T. rips estm.	7000
9. Surface Reaeration estm. lbs/d	8000
10. D.O. Nezinscot lbs/d	13920
11. Total D.O.	229420
12. D.O. leaving T.C.	198980
13. D.O. available	30440
Water Temperature average °C N.T. 20.6° T.C. 21.0°	20.8°
River Flow average cfs N.T.	5108
River Flow average cfs T.C.	5634

Fish, white perch and catfish, gulls and cormorants were present in the area, the gulls were too numerous to count. A farmer who lives near the Nezinscot river estimated the cormorants as about fifty.

3. <u>Turner Center</u>. Pool water sampled at this location contained a large excess of dissolved oxygen through the testing season, sufficient to satisfy the ultimate biochemical oxygen demands of the accompanying pollution loads. The ratios for the four periods were:

Period	B.O.D.5	D.O.	B.O.D.ult.	D.O.
May 31-June 26	1.00	2.80	1.00	1.90
June 28-July 24	1.00	3.34	1.00	2.27
July 26-Aug. 28	1.00	3.34	1.00	2.27
Aug. 30-Sept. 13	1.00	3.59	1.00	2.44
May 31-Sept. 13	1.00	3.20	1.00	2.20

These statistics indicate an improved water quality when compared to that of 1975, 1974 and 1973. In 1973 from July thirty to September fourteen, a continuous deficit of dissolved oxygen was recorded.

Floating sludge appeared to be smaller and less numerous than that of the previous two seasons, however, a few 'floaters' were observed passing downstream as late as September 23. Objectionable odor, usually pig-pen, was detected at the bridge on fifteen days during June and July but only two days in August and none in September. Foam was occasionally observed.

A citizen informed the writer that "on an afternoon in June, sludge and foam covered a large area of the water paralell to the road" (Bay 16).

DISSOLVED OXYGEN - BIOCHEMICAL OXYGEN DEMAND

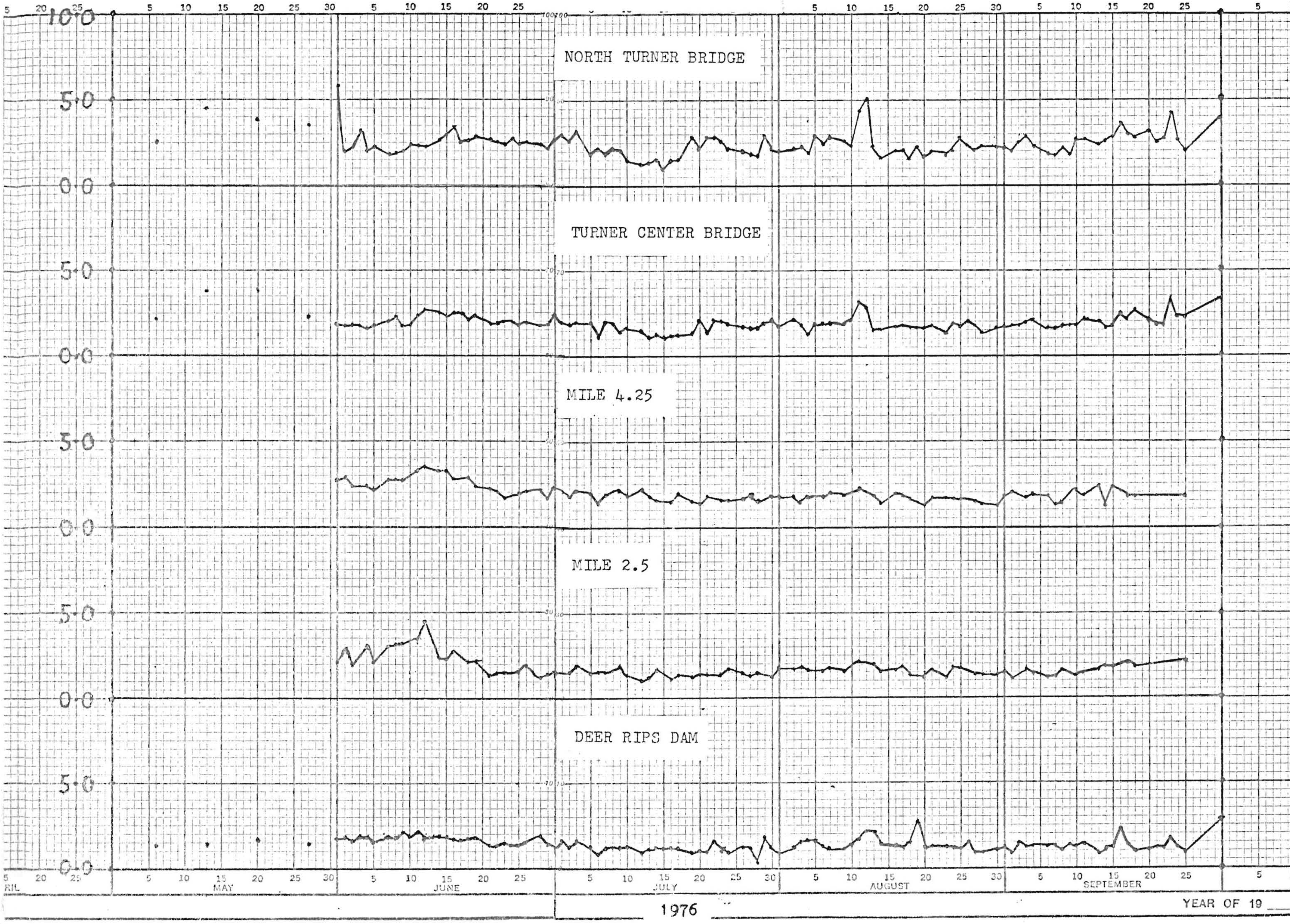
TURNER CENTER BRIDGE

(6 day)

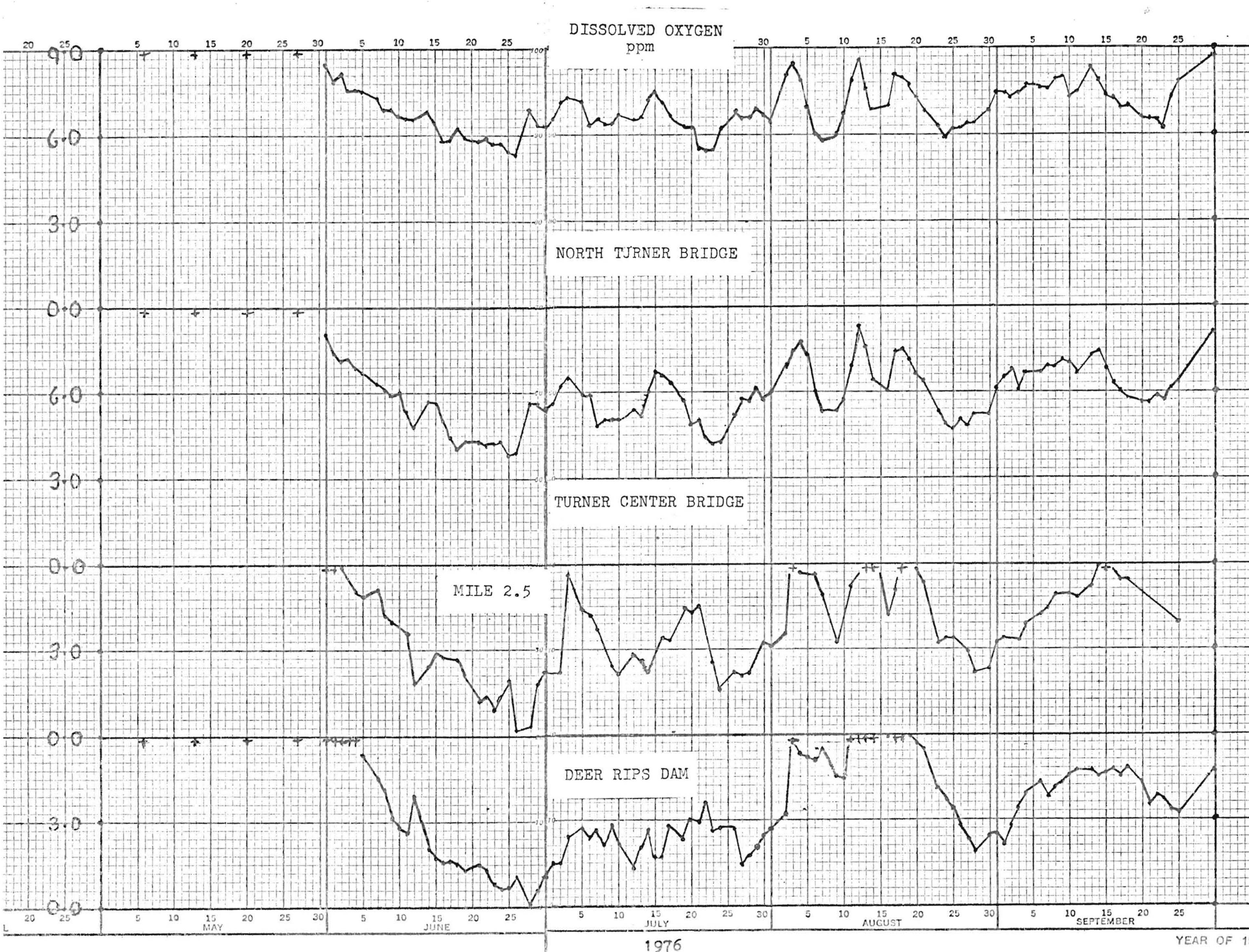
Weekly Averages 1976

Week Beginning	FLOW cfs	TEMP. °C	pH	D.O. ppm	D.O. lbs/day	B.O.D. 5 ppm	lbs/day
May 31	4580	18.3	6.7	7.2	179380	1.8	43880
June 7	3520	20.7	6.6	5.7	109450	2.2	40640
14	3149	22.5	6.6	4.8	82000	2.4	40200
21	3414	24.5	6.5	4.1	75270	1.9	34650
Average	3665	21.5	6.6	5.5	111530	2.1	39840
June 28	4469	21.4	6.6	5.8	141490	2.0	46760
July 5	3299	23.2	6.7	5.3	94120	1.7	29690
12	3899	22.4	6.8	6.0	127310	1.3	26150
19	3124	23.4	6.8	4.8	80900	1.8	30340
Average	3697	22.6	6.7	5.5	110960	1.7	33240
July 26	4017	21.5	6.8	5.8	124900	1.8	38810
Aug. 2	5184	19.5	6.7	6.8	193420	1.8	51210
9	8462	20.3	6.6	6.7	320570	2.2	111970
16	7162	20.5	6.7	6.8	265810	1.7	65810
23	3347	23.3	6.6	5.0	90160	1.7	30340
Average	5634	21.0	6.7	6.2	198980	1.8	59630
Aug. 30	4040	19.6	6.8	6.2	135380	1.8	39900
Sept. 6	3185	17.6	6.9	6.9	118350	1.8	30660
Aug. 30-Sept.11 Average	3612	18.6	6.9	6.6	126870	1.8	35280
SEASON AVERAGE	4323	21.2	6.7	5.9	142570	1.8	44070
Sept. 13-18	3542	19.0	6.8	6.6	127470	2.1	39750
20-25	3090	18.7	6.8	5.9	101130	2.2	35890
Sept. 30		13.8	6.7	8.0		3.3	

BIOCHEMICAL OXYGEN DEMAND
5 day - 20°C ppm



11


DISSOLVED OXYGEN
ppm
NORTH TURNER BRIDGE
TURNER CENTER BRIDGE
MILE 2.5
DEER RIPS DAM
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1976
YEAR OF 19

12

TURNER CENTER BRIDGE

Period*	Dissolved Oxygen lbs/day	ppm	B.O.D.5 lbs/day	ppm	N.T.B. → T.C.B. D.O.lb/d	B.O.D.lb/d
May 31 to June 26	111530	5.5	39840	2.1	-13260	-8580
June 28 to July 24	110960	5.5	33240	1.7	-11090	-5810
July 26 to Aug. 28	198980	6.2	59630	1.8	- 1520	-9880
Aug. 30 to Sept.11	126870	6.6	35280	1.8	-10400	-5610
SEASON AVERAGE	142570	5.9	44070	1.8	- 8390	- 7780

TURNER CENTER to MILE 4.25

TURNER CENTER BRIDGE - MILE 4.25 AREA

July 26 - August 28

Station	Dissolved Oxygen lbs/day	ppm	B.O.D.5 lbs/day	ppm	Temp. av.°C	FLOW av.cfs
T.C.B.*	198980	6.2	59630	1.8	21.0	5634
Mile 4.25**	168290	5.1	54350	1.7	21.4	5673
Change	- 30690	-1.1	- 5280	-0.1	≠ 0.4	≠ 39

* Six day/week
**Five day/week

The measured <u>loss</u> of dissolved oxygen in this area is always larger than that of the five day biochemical oxygen demand. During the 'August period' the ratios are for 1976 5.81, 1975 5.5, 1974 23.4.

BENTHAL

Bottom deposits were active through the entire testing season. "Floaters" were smaller and less numerous than in previous years. Gassing was observed to force solids to the surface which frequently sank after a minute or two. This appears to indicate that much of the upper layers of the deposits are not as compact and/or as cohesive as those observed for many years. The persistent "floaters" were seldom more than six inches in diameter and varied in thickness from four to six inches. Odor in the area was intermittent and usually had a low intensity.

Estimates of the benthal contribution to the pollution load in this area, appear to be about 19000 lbs/day of five day biochemical oxygen demand.

BENTHAL B.O.D.5 CONTRIBUTION (Estimate)

Turner Center - Mile 4.25

July 26 - August 28, 1976

1. T.C. B.O.D.5 entering area	59630	lbs/day	
2. Mile 4.25 B.O.D.5 leaving area	54350	"	"
3. B.O.D. Measured decrease	5280	"	"
4. Estm. B.O.D.5 decrease T.C. #1 remainder	16000	"	"
5. Benthal B.O.D.5 Estm. (40690-21280)	19410	"	"
6. D.O. entering area	198980	"	"
7. D.O. aeration	10000	"	"
8. D.O. available	208980	"	"
9. D.O. leaving area	168290	"	"
10. Decrease	40690	"	"

Fish and gulls were present every day through the season but cormorants were very seldom observed and than only one or two.

4. <u>Mile 4.25</u> Water samples are obtained from a boat located at the downstream end of the 'narrows', about half way from each shore.

MILE 4.25

Period*	Dissolved Oxygen lbs/day	ppm	B.O.D.5 lbs/day	ppm	T.C.B. → Mile 4.25 D.O. lbs/d	B.O.D. lbs/d
May 31 to June 26	87490	4.3	49100	2.6	-24040	-9260
June 28 to July 24	83540	4.2	35560	1.8	-27420	-2320
July 26 to Aug. 28	168290	5.1	54350	1.7	-30690	-5280
Aug. 30 to Sept.11	108740	5.7	33770	1.7	-18130	-1510
SEASON AVERAGE	115800	4.4	45200	2.0	-26770	≠1130

*Five day

Water entering this area had a dissolved oxygen content, more than enough to satisfy the ultimate biochemical demands. The smallest ratio was recorded during the fourth week of the June period, when 47060 lbs/day (2.6 ppm) D.O. was available for 35630 lbs/day (1.9 ppm) B.O.D.5.

The ratios for the four periods are:

Period	B.O.D.5	D.O.	B.O.D.ult.	D.O.
May 31-June 26	1.00	1.78	1.00	1.21
June 28-July 24	1.00	2.35	1.00	1.60
July 26-Aug. 28	1.00	3.10	1.00	2.10
Aug. 30-Sept.13	1.00	3.22	1.00	2.19
SEASON AVERAGE	1.00	2.56	1.00	1.74

MILE 4.25 to MILE 2.5

MILE 4.25 - MILE 2.5

July 26 - August 28

Location	Dissolved Oxygen lbs/day	ppm	B.O.D.5 lbs/day	ppm	TEMP. av.°C	FLOW av.cfs
Mile 4.25	168290	5.1	54350	1.7	21.4	5673
Mile 2.5	141500	4.3	51220	1.6	21.9	5673
Change	- 26790	-0.8	- 3130	-0.1	≠ 0.5	

DISSOLVED OXYGEN - BIOCHEMICAL OXYGEN DEMAND

MILE 4.25*

Weekly Averages

1976

Week Beginning	FLOW cfs	TEMP. °C	pH	Dissolved Oxygen ppm	Dissolved Oxygen lbs/day	B.O.D.5 ppm	B.O.D.5 lbs/day
May 31	4622	18.5	6.6	6.3	155010	2.5	60290
June 7	3524	21.2	6.5	4.6	83340	3.0	51320
14	3144	23.3	6.5	3.8	64560	2.9	49150
21	3440	25.3	6.4	2.6	47050	1.9	35630
Average	3682	22.1	6.5	4.3	87490	2.6	49100
June 28	4456	22.0	6.5	4.2	101870	1.9	46060
July 5	3360	23.7	6.6	4.2	75540	1.9	33660
12	3824	23.6	6.6	4.5	92650	1.8	36050
19	3198	23.8	6.7	3.7	64080	1.5	26460
Average	3709	23.3	6.6	4.2	83540	1.8	35560
July 26	3890	22.3	6.7	4.4	92710	1.7	36060
Aug. 2	5372	19.7	6.7	6.0	175590	1.8	50660
9	8222	20.6	6.6	5.9	276210	1.8	87930
16	7498	20.8	6.6	6.0	239800	1.7	68560
23	3384	23.5	6.5	3.1	57120	1.6	28550
Average	5673	21.4	6.6	5.1	168290	1.7	54350
Aug. 30	4080	20.1	6.7	5.1	110460	1.7	37980
Sept. 6	3188	17.8	6.7	6.2	107010	1.7	29550
Aug. 30-Sept.11 Average	3634	19.0	6.7	5.7	108740	1.7	33770
SEASON AVERAGE	4346	21.8	6.6	4.4	115800	2.0	45200
Sept. 13-18	3606	19.1	6.8	6.0	118170	1.9	37270
Sept.25	2980	17.0	6.7	4.9	78684	1.7	27300

*Five day week

BENTHAL

Sludge 'floaters' were present in this area during June and July, qualitatively about the same as last year. During August they were seldom observed and none were recorded during September. Gassing was extensive and voluminous during the entire season. During the week beginning August thirty the gas rising to the surface was the largest ever observed by the writer. The peak was on September one when the area was covered from shore to shore with persistent bubbles. Large amounts of suspended solids were deposited in this sector for about two weeks, during and after the high river flows which began on August ten.

The measured losses and gains of both dissolved oxygen and biochemical oxygen demand during a seven year period are:

Year	'Short' Period D.O. lbs/d	'Short' Period B.O.D.5 lbs/d	Season D.O. lbs/d	Season B.O.D.5 lbs/d
1976	-26790	- 3130	-23730	- 4080
1975	-10800	- 3660	-16410	- 3820
1974	-25110	- 4960	-24420	- 760
1973	-16630	≠30750	- 2368	≠18290
1972	-25040	- 7010	-25820	- 6620
1971	- 1230	≠ 9990	-17170	- 5410
1970	- 9300	- 7600	- 900	≠ 3350

BENTHAL B.O.D.5 CONTRIBUTION (Estimated)

Mile 4.25 - Mile 2.5

July 26 - August 28, 1976

1.	B.O.D.5 entering area	54350 lbs/day
2.	B.O.D.5 leaving area	51220 " "
3.	Measured decrease	3130 " "
4.	Estm. decrease of N.T. remainder #1	15800 " "
5.	Benthal B.O.D.5 estm. (39790-18930)	20860 " "
6.	D.O. entering area	168290 " "
7.	D.O. reaeration	13000 " "
8.	D.O. available	181290 " "
9.	D.O. leaving area	141500 " "
10.	Decrease	39790 " "

Fish and gulls were present every day through the season. Dead fish were not observed.

The blue-green algae problem is described later in this report.

5. Mile 2.5

MILE 2.5

Period*	Dissolved Oxygen		B.O.D.5		Mile 4.25 – Mile 2.5	
	lbs/day	ppm	lbs/day	ppm	D.O. lbs/d	BOD lbs/d
May 31 to June 26	70870	3.4	48160	2.4	-16620	- 940
June 28 to July 24	60030	3.1	28350	1.4	-23510	-7210
July 26 to Aug. 28	141500	4.3	51220	1.6	-26790	-3130
Aug. 30 to Sept.11	74960	3.9	27330	1.4	-33780	-6440
SEASON AVERAGE	92070	3.7	41120	1.7	-23730	-4080

*Five day

Dissolved oxygen, in the water passing this station was usually sufficient to meet both the ultimate biochemical oxygen demands however, an oxygen deficit existed during one week (June 21-26); D.O. 20130 lbs/day and B.O.D.5 28600 lbs/day. The ratios for the four periods are:

Period	B.O.D.5	D.O.	B.O.D.ult.	D.O.
May 31-June 26	1.00	1.47	1.00	1.00
June 28-July 24	1.00	2.12	1.00	1.44
July 26-Aug. 28	1.00	2.76	1.00	1.88
Aug. 30-Sept.11	1.00	2.74	1.00	1.86
SEASON AVERAGE	1.00	2.24	1.00	1.52

DISSOLVED OXYGEN - BIOCHEMICAL OXYGEN DEMAND

MILE 2.5*

Weekly Averages

1976

Week Beginning	FLOW cfs	TEMP. °C	pH	Dissolved Oxygen ppm	Dissolved Oxygen lbs/day	B.O.D.5 ppm	B.O.D.5 lbs/day
May 31	4622	18.6	6.5	6.0	148230	2.4	59290
June 7	3524	21.3	6.3	3.8	72420	3.5	65170
14	3144	23.1	6.3	2.5	42700	2.3	39570
21	3440	25.2	6.3	1.1	20130	1.5	28600
Average	3682	22.1	6.4	3.4	70870	2.4	48160
June 28	4456	23.3	6.4	2.4	60800	1.5	35940
July 5	3360	23.5	6.5	3.4	61210	1.5	27440
12	3823	24.3	6.5	2.9	58010	1.2	25600
19	3198	24.0	6.6	3.5	60080	1.4	24430
Average	3709	23.8	6.5	3.1	60030	1.4	28350
July 26	3890	23.2	6.6	2.4	53230	1.4	30390
Aug. 2	5372	20.5	6.6	5.2	146590	1.7	48950
9	8222	20.8	6.6	5.4	243230	1.8	87240
16	7498	21.2	6.5	5.3	207070	1.5	62990
23	3384	23.6	6.5	3.0	55370	1.5	26550
Average	5673	21.9	6.6	4.3	141500	1.6	51220
Aug. 30	4080	21.5	6.5	3.2	70260	1.4	31320
Sept. 6	3188	18.6	6.6	4.6	79650	1.4	23340
Aug. 30-Sept.11 Average	3634	20.1	6.6	3.9	74960	1.4	27330
SEASON AVERAGE	4346	22.2	6.5	3.7	92070	1.7	41120
Sept. 13-18	3606	19.3	6.7	5.7	109790	1.8	35460
Sept. 25	2980	17.9	6.6	3.9	62626	2.2	35328

*Five day week

MILE 2.5 to DEER RIPS DAM

MILE 2.5

Period	Dissolved Oxygen lbs/day	Dissolved Oxygen ppm	B.O.D.5 lbs/day	B.O.D.5 ppm	Mile 2.5 → D.R.D. D.O. lbs/d	Mile 2.5 → D.R.D. B.O.D. lbs/d
May 31-June 26	70870	3.4	48160	2.4	- 700	-1490
June 28-July 24	60030	3.1	28350	1.4	- 1900	-4210
July 26-Aug. 28	141500	4.3	51220	1.6	+19400	-8260
Aug. 30-Sept. 11	74960	3.9	27330	1.4	+ 7190	+3780
SEASON AVERAGE	92070	3.7	41120	1.7	+ 250	-8360

MILE 2.5 - DEER RIPS DAM

July 26 - August 28

Location	Dissolved Oxygen lbs/day	Dissolved Oxygen ppm	B.O.D.5 lbs/day	B.O.D.5 ppm	TEMP. av. °C	FLOW av. cfs*
Mile 2.5	141500	4.3	51220	1.6	21.9	5673
Deer Rips Dam	160900	4.5	42960	1.3	21.7	5673
Change	+ 19400	+0.2	- 8260	-0.3		

*Sampling days

In this sector two sampling stations are located, Mile One and at Gulf Island Dam. The daily data are tabulated and placed at the end of this report. Water samples from a seven foot depth at the Dam are not representative of conditions which exist, partly due to the fact that the power plant operates 'bottom draw'

BENTHAL

Benthal in this area is active from Mile 2.5 to about Mile One, however, a gradient exists, the active deposits lay between Mile 2.5 and Mile 1.5, but sludge rising to the surface seldom is observed. 'Floaters' are observed in the area when wind direction and velocity force them downstream.

This season gassing was more frequent in the sector Mile One to Mile 2.5 than in 1975. Bottom deposits downstream from Mile 0.75 principly are black humus and silt.

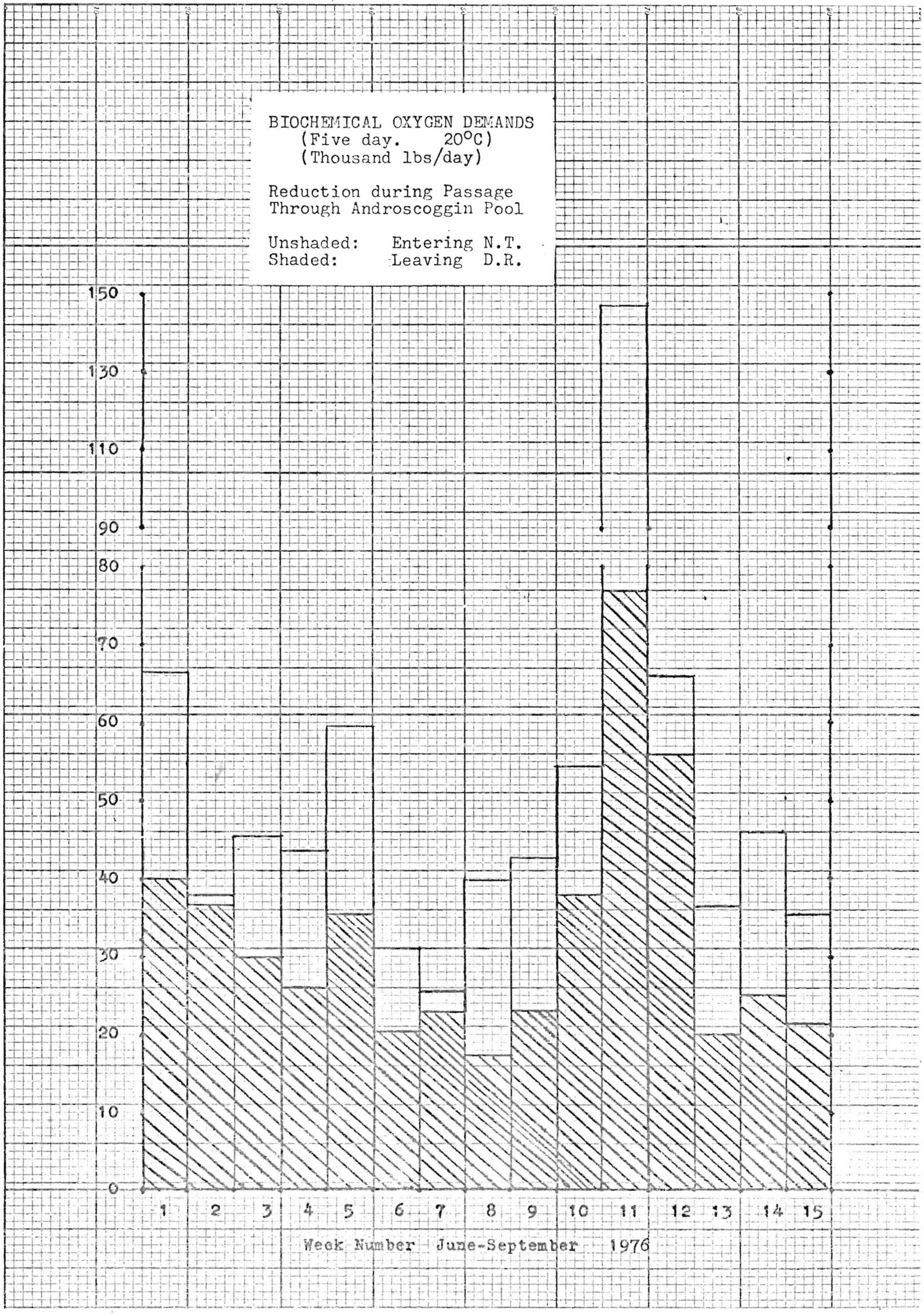
Estimates of the pollution originating in the bottom deposits in the Mile 2.5 to Deer Rips Dam were made but are rejected because of erratic flows during August and the non-representative dissolved oxygen data at the Gulf Island Dam. Large scale spilling of water over the Dam produced a large increase of dissolved oxygen, hence the high concentrations reported for the 'August' period at Deer Rips Dam.

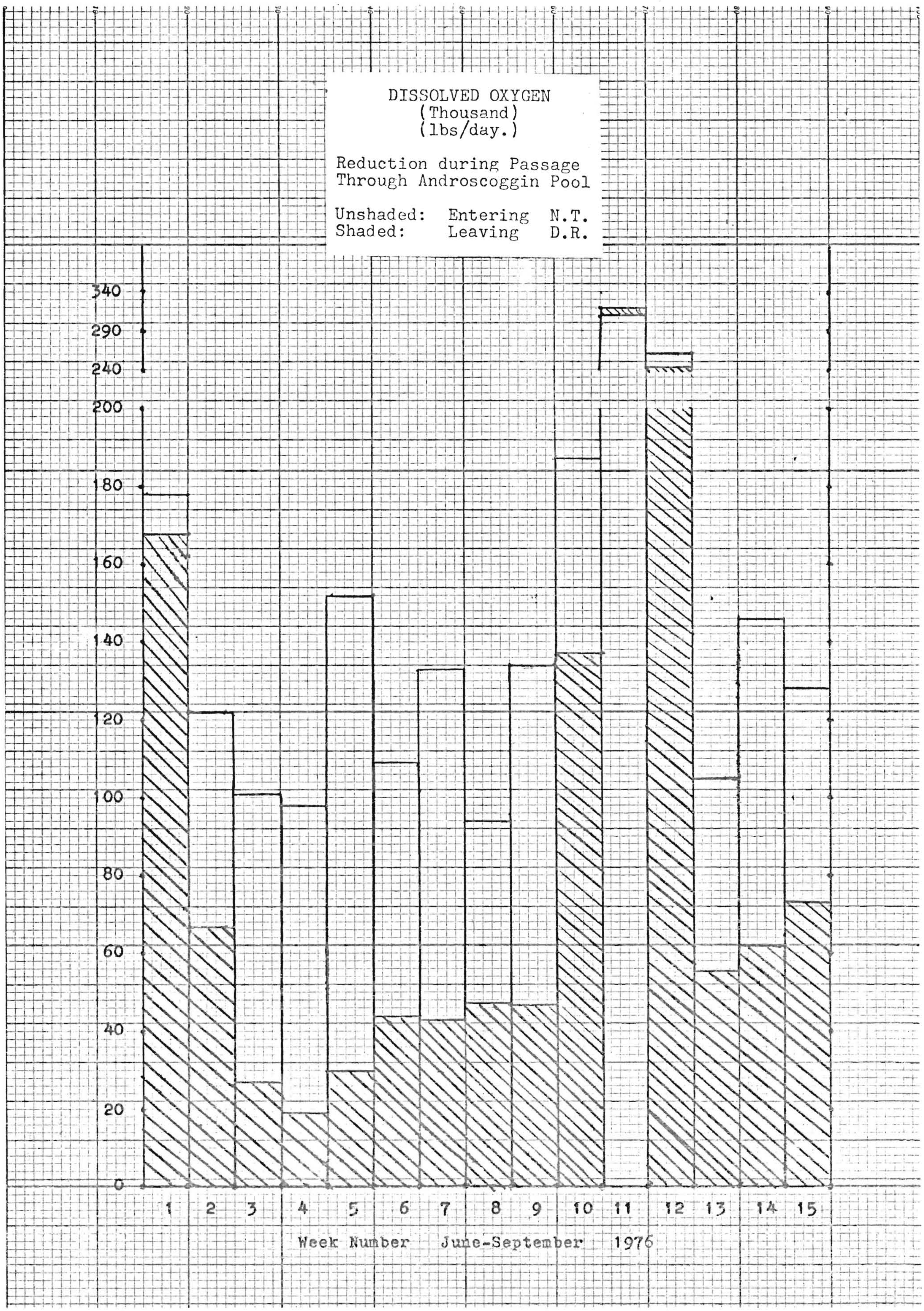
6. Deer Rips Dam. This location is considered the southern end of the Androscoggin Pool. Water sampled at the entrance to the powerhouse is representative of the entire flow at this location.

DEER RIPS DAM

Period*	Dissolved Oxygen		B.O.D.5		N.TB. → D.R.D	
	lbs/day	ppm	lbs/day	ppm	D.O.lbs/d	B.O.D.lbs/d
May 31-June 26	70170	3.2	33250	1.7	-54620	-15170
June 28-July 24	41030	2.2	24140	1.2	-81020	-14910
July 26-Aug.28	160900	4.5	42960	1.3	-39600	-26550
Aug. 30-Sept.11	67770	3.6	23550	1.3	-69500	-17340
SEASON AVERAGE	92320	3.4	32760	1.4	-58640	-19190

*Six day/week


BIOCHEMICAL OXYGEN DEMANDS
(Five day. 20°C)
(Thousand lbs/day)
Reduction during Passage
Through Androscoggin Pool
Unshaded: Entering N.T.
Shaded: Leaving D.R.
150
130
110
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Week Number June-September 1976


DISSOLVED OXYGEN
(Thousand)
(lbs/day.)
Reduction during Passage Through Androscoggin Pool
Unshaded: Entering N.T.
Shaded: Leaving D.R.
340
290
240
200
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Week Number June-September 1976

The measured Biochemical Oxygen Demand and Dissolved Oxygen lbs/day ratios are:

Period	B.O.D.5	D.O.	B.O.D.ult.	D.O.
May 31-June 26	1.00	2.11	1.00	1.43
June 28-July 24	1.00	1.70	1.00	1.16
July 26-Aug. 28	1.00	3.74	1.00	2.54
Aug. 30-Sept.11	1.00	2.87	1.00	1.95
SEASON AVERAGE	1.00	2.60	1.00	1.77

These statistics indicate that the river water leaving the Pool contained sufficient dissolved oxygen to satisfy both the five day and the ultimate biochemical oxygen demands.

Note: In this report the ultimate B.O.D. is calculated from B.O.D.5 ~~divided~~ by 1.47, the twenty day demand at 20°C. Temperature for 24°C the diversor is 1.62. All average ultimate B.O.D.'s at 24°C are met with but one exception May 31-June 26 at Mile 2.5.

multiplied by.

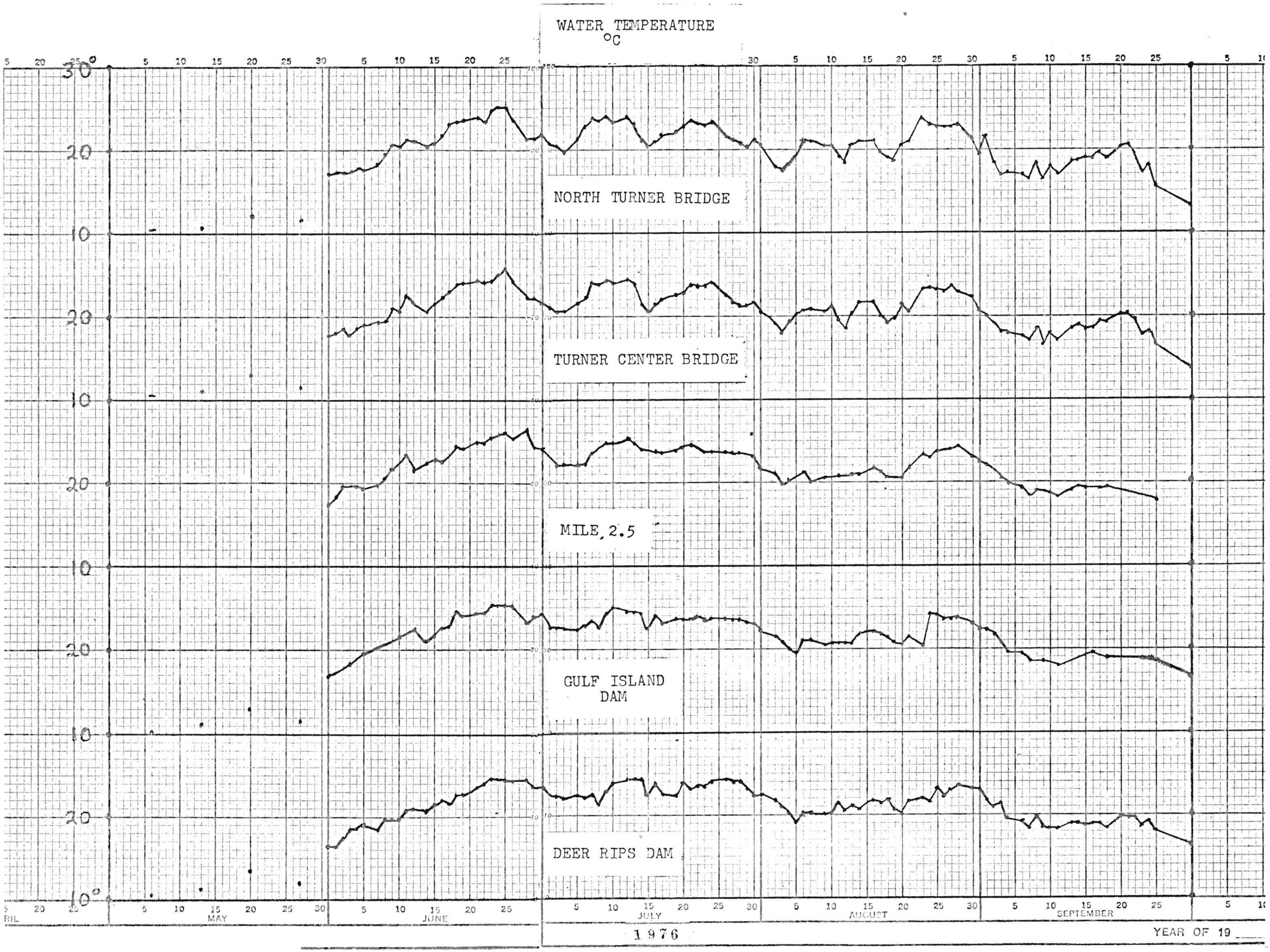
DISSOLVED OXYGEN - BIOCHEMICAL OXYGEN DEMAND

DEER RIPS DAM

Weekly Averages

1976

Week Beginning	FLOW cfs	TEMP. °C	pH	D.O. ppm	D.O. lbs/day	B.O.D.5 ppm	B.O.D.5 lbs/day
May 31	4581	17.6	6.5	6.8	168140	1.7	40230
June 7	3521	20.0	6.3	3.5	66550	1.9	36430
14	3150	21.9	6.3	1.6	27410	1.8	29980
21	3415	24.4	6.3	1.0	18570	1.4	26340
Average	3666	21.0	6.4	3.2	70170	1.7	33250
June 28	4470	23.1	6.3	1.2	30120	1.5	35520
July 5	3300	22.4	6.4	2.5	43680	1.2	20430
12	3900	23.5	6.5	2.0	42810	1.1	23180
19	3125	23.4	6.4	2.9	47510	1.1	17410
Average	3698	23.1	6.4	2.2	41030	1.2	24140
July 26	4018	23.4	6.5	2.2	47070	1.1	23150
Aug. 2	5185	20.4	6.4	5.0	137700	1.4	38000
9	8463	20.7	6.5	6.3	319320	1.6	77270
16	7163	21.3	6.5	6.2	244900	1.5	56180
23	3348	22.6	6.3	3.0	55500	1.1	20180
Average	5635	21.7	6.4	4.5	160900	1.3	42960
Aug. 30	4041	21.7	6.4	2.9	61970	1.2	25330
Sept. 6	3186	18.3	6.5	4.3	73560	1.3	21760
Aug. 30- Sept. 11 Average	3613	20.0	6.5	3.6	67770	1.3	23550
SEASON AVERAGE	4324	21.7	6.4	3.4	92320	1.4	32760
Sept. 13-18	3543	18.9	6.5	4.6	88440	1.3	24830
20-25	3091	19.2	6.5	3.6	69040	1.2	20290
Sept. 30		16.1	6.3	4.7		2.7	


WATER TEMPERATURE
°C
NORTH TURNER BRIDGE
TURNER CENTER BRIDGE
MILE 2.5
GULF ISLAND
DAM
DEER RIPS DAM
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1976
YEAR OF 19

WATER TEMPERATURES °C

Water temperatures were measured at Gulf Island Dam at the sampling depth of about seven feet. Temperatures recorded for June through September probably are about 0.4°C higher than those existing at the twenty foot depth. The continuous temperature recorder was not utilized this year due to mechanical defects. The bulb of the probe was at the twenty foot level since installation about twenty-five years ago.

WATER TEMPERATURE (°C)

GULF ISLAND DAM

Year	May*	June	July	August	September
1976	11.4	21.7	23.4	21.6	19.5**
1975	12.8	19.1	24.5	23.5	18.9
1974	9.5	18.8	22.4	23.5	19.7
1973	11.2	18.6	22.7	24.7	19.9
1972	9.3	19.3	23.1	21.2	20.0
1971	11.5	20.7	24.2	23.6	20.7
1970	11.4	21.1	23.1	24.7	19.1
1969	9.0	19.4	22.5	22.4	20.2
1968	12.6	19.0	23.5	22.4	20.0
1967	8.9	19.7	23.4	23.8	20.4
1966	10.9	20.4	24.1	23.0	20.2
34 Year Average	11.9	19.9	23.5	23.0	19.5
Deviation	- 0.5	≁ 1.8	- 0.1	- 1.4	0.0

*Thursday's only **To September 18

During the season, May 31 to September 11, the river flow at Deer Rips Dam averaged 4324 cfs and 21.7°C; 1975, 3177 cfs and 21.8°C.

The dissolved oxygen record:

21 days above 4.0 ppm maximum 8.4 ppm (8.2 ppm Aug. 12)
5 days below 1.0 ppm
1 day below 0.5 ppm
1 day was 0.1 ppm minimum 0.1 ppm

Dissolved oxygen and biochemical oxygen demands in the water <u>leaving</u> the Pool were larger than those in 1975; the daily averages for four seasons are:

	D.O. lbs/day Average	B.O.D.5 lbs/day Average	Flow cfs Average	Temp.°C Average
1976	92320	32760	4324	21.7
1975	59880	28740	3177	21.8
1974	93820	44430	4376	21.3
1973	152950	95490	5891	22.1

HYDROGEN ION CONCENTRATION

At Deer Rips hydrogen ion concentration (in pH units) ranged from 6.1 to 6.6; season average 1976, 6.4, 1975, 6.4. A pH gradient always is present in the Pool; this season the North Turner average is 6.8 and Deer Rips 6.4. The increased acidity probably is due to the diffusion of organic acids from the benthal deposits.

NORTH TURNER BRIDGE - DEER RIPS DAM

NORTH TURNER BRIDGE - DEER RIPS DAM

July 26 - August 30

Location	Dissolved Oxygen lbs/day	Dissolved Oxygen ppm	B.O.D.5 lbs/day	B.O.D.5 ppm	TEMP. av.°C	FLOW av.cfs
N.T.B. in	200500	7.0	69510	2.3	20.6	5108
D.R.D. out	160900	4.5	42960	1.3	21.7	5635
Change	- 39600	-2.5	-26550	-1.0	+ 0.9	+ 527

The <u>decrease</u> of dissolved oxygen would have been larger if the spilling at Gulf Island Dam during 'August' had been normal. For every pound of B.O.D.5 leaving the Pool during August, 3.74 pounds of oxygen were available to meet that demand, cf page 24.

LIGNIN TYROSINE TESTS

Lignin tests were conducted on water sampled at five locations from North Turner to Deer Rips Dam. Daily statistics are recorded on adjacent pages. North Turner and Deer Rips data are plotted on page 30

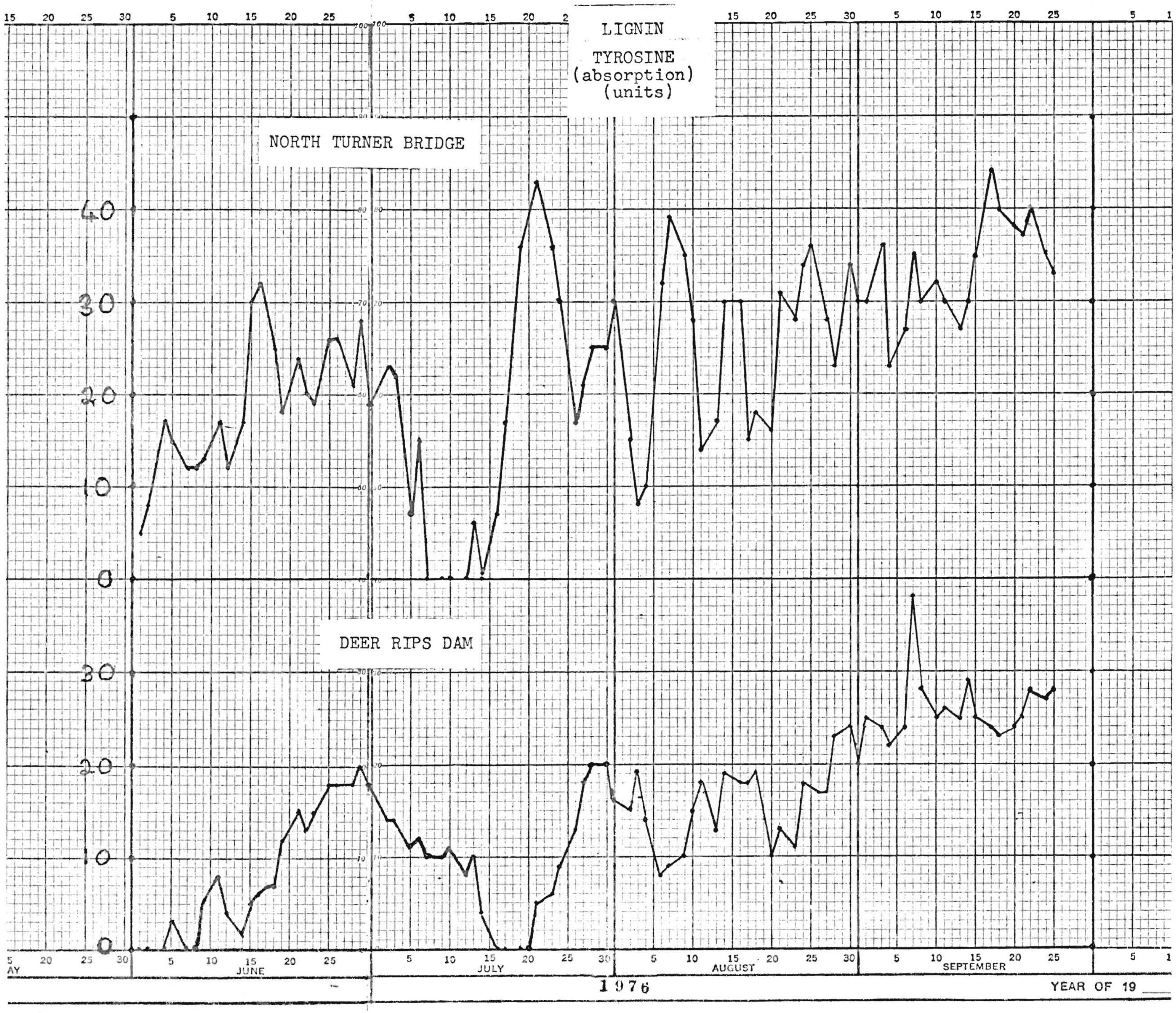
Concentration of Lignin slowly decreases as the river water traverses the Pool, probably due to coagulation and settling to the bottom.

LIGNIN STATISTICS 1976

Absorption Units

Summary Monthly Averages

	N.T.	T.C.	Mile 4.25	Mile 2.5	D.R.D.
June	19	--	--	--	8
July	17	13	14	12	9
August	25	22	21	20	16
September	32	29	28	26	26


LIGNIN
TYROSINE
(absorption)
(units)
NORTH TURNER BRIDGE
DEER RIPS DAM
40
30
20
10
0
30
20
10
0
JUNE
JULY
AUGUST
SEPTEMBER
1976
YEAR OF 19

LIGNIN (Tyrosine Test)

Date	North Turner	Turner Center	Mile 4.25	Mile 2.5	Deer Rips Dam
June					
1	5				0
2	8				0
4	17				0
5	15				3
7	12				0
8	12				0
9	13				5
11	17				8
12	14				4
14	17				2
15	30				5
16	32				6
18	25				7
19	18				12
21	24				15
22	20				13
23	19				15
25	26				18
26	26				18
28	21				18
29	28				20
30	19				18
Average	19				8
July					
2	23				14
3	22				14
5	7	9			11
6	15	5			12
7	0	13			10
9	0	3			10
10	0	0			11
12	0	0			8
13	6	0	0	0	10
14	0	0	0	0	4
16	7	0	0	0	0
17	17	10	4	0	0
19	36	18	10	6	0
20	20	30	19	3	0
21	43	18	27	16	5
23	36	33	31	23	6
24	30	36	28	22	9
26	17	26	22	26	13
27	21	16	24	26	18
28	25	19	14	22	20
30	25	25	25	19	20
31	30	16	19	17	16
Average	17	13	14	12	9

LIGNIN (Tyrosine Test)

Date	North Turner	Turner Center	Mile 4.25	Mile 2.5	Deer Rips Dam
August					
2	15	20	25	17	15
3	8	13	13	18	19
4	10	10	9	14	14
6	32	26	14	8	8
7	39	28	24	17	9
9	35	26	29	26	10
10	28	30	--	--	15
11	14	25	25	23	18
13	17	9	9	13	13
14	30	27	17	13	19
16	30	25	24	23	18
17	15	12	20	22	18
18	18	14	14	15	19
20	16	15	13	10	10
21	31	19	19	19	13
23	28	22	28	20	11
24	34	26	27	27	18
25	36	30	23	25	17
27	28	30	31	25	17
28	33	28	31	30	23
30	34	34	29	25	24
31	30	27	28	27	20
Average	25	22	21	20	16
September					
1	30	28	28	26	25
3	36	29	29	22	24
4	23	35	29	26	22
6	27	26	25	25	24
7	35	32	27	28	38
8	30	26	26	28	28
10	32	35	26	25	25
11	30	34	32	24	26
13	27	20	35	31	25
14	34	25	27	29	29
15	35	25	28	24	25
17	44	37	32	24	24
18	40	37	32	28	23
1 to 18 Average	32	29	28	26	26
20	38	35			24
21	37	32			25

RECAPITULATIONS

Season Averages May 31-Sept. 11

Location	Dissolved Oxygen ppm	Dissolved Oxygen lbs/day	B.O.D.5 ppm	B.O.D.5 lbs/day	D.O. Deficit-Surplus+
1. N.T. Bridge[x]	6.9	150960	2.3	51950	+ 99010
2. T.C. Bridge[x]	5.9	142570	1.8	44070	+ 98500
3. Mile 4.25*	4.4	115800	2.0	45200	+ 70600
4. Mile 2.5*	3.7	92070	1.7	41120	+ 50950
5. Deer Rips Dam[x]	3.4	92320	1.4	32760	+ 59560

July 26 - August 28

Location	Dissolved Oxygen ppm	Dissolved Oxygen lbs/day	B.O.D.5 ppm	B.O.D.5 lbs/day	D.O. Deficit-Surplus+
1. N.T. Bridge[x]	7.0	200500	2.3	69510	+130990
2. T.C. Bridge[x]	6.2	198980	1.8	59630	+139350
3. Mile 4.25*	5.1	168290	1.7	54350	+113940
4. Mile 2.5*	4.3	141500	1.6	51220	+ 90280
5. Deer Rips Dam[x]	4.5	160900	1.3	42960	+117940

*Five days each week
[x]Six days each week

NORTH TURNER BRIDGE - DEER RIPS DAM

Sector	Period	D.O. lbs/day decrease	B.O.D. lbs/day decrease
N.T.B.-T.C.B.	July 26-Aug. 28	1520	9880
	May 31-Sept. 11	8390	7880
T.C.B.-D.R.D.	July 26-Aug. 28	38080	16670
	May 31-Sept. 11	50250	11310
N.T.B.-D.R.D.	July 26-Aug. 28	39600	26550
	May 31-Sept. 11	58640	19190

All of these statistics are calculated from the analytical results.

BENTHAL B.O.D.5 CONTRIBUTION

(Estimate)

N.T.-T.C.-D.R.D.

July 26 - August 28, 1976

1. North Turner-Turner Center	6100	lbs/day
2. Turner Center-Mile 4.25	19400	"
3. Mile 4.25-Mile 2.5	20900	"
4. Mile 2.5-Deer Rips Dam	?	"

APPROXIMATE k_1 RATES

July 26-August 28, 1976

Sector	k_1	T.P.
1. North Turner-Turner Center	0.13	18 hrs.
2. Turner Center-Mile 4.25	0.13	30 "
3. Mile 4.25-Mile 2.5	0.10	40 "
4. Mile 2.5-Deer Rips Dam	----	--

Note: Calculation; B.O.D.5 into area plus Estm. Benthal B.O.D.5 minus B.O.D.5 out of area.

LEWISTON-AUBURN AREA

River water passing through the canal system was sampled daily from Chestnut Street bridge and tested for Temperature, pH and Dissolved Oxygen. Biochemical Oxygen Demand was determined only on the Thursday sample; the results usually are similar to those obtained at Deer Rips dampling station.

DISSOLVED OXYGEN

Lewiston Canal

Season	Below ONE ppm	Below 0.5 ppm
1976	0 days	0 days
1975	0 "	0 "
1974	12 "	2 "
1973	46 "	30 "
1972	16 "	3 "
1971	67 "	46 "
1970	30 "	15 "
1969	14 "	5 "
1968	44 "	31 "
1967	35 "	12 "
1966	26 "	13 "
1965	0 "	0 "

Season daily average 4.2 ppm

Water quality, based on the content of dissolved oxygen, was higher than that recorded for, at least, a decade, the monthly averages of the daily tests are:

June	3.81 ppm	July	3.1 ppm
August	5.80 ppm	September	4.2 ppm

The lowest recorded D.O. is 1.0 ppm, June 29 and the highest 8.4 ppm, August 12.

Biochemical Oxygen Demand (five day 20°)

June	1.7 ppm	July	1.4 ppm
August	1.6 ppm	September	2.4 ppm

Thursday's only

Observations were made daily on Atmospheric and Water Surface conditions, including

1. Air temperatures °C
2. General weather
3. Wind direction
4. River odor at six locations

Reports were mailed on alternate Monday's to Messrs Cooper, Hanson and Linder.

MEAN HOURLY TEMPERATURES °F

Mean hourly temperatures, reported by the Union Water Power Company, were above the ninety-two year average during May, June, August and September and below average in July. The average temperature for June (68.22) was almost five degrees higher than the ninety-two year average.

Mean Hourly Temperatures (°F)

Year	May	June	July	August	September
1976	54.15	68.22	68.19	67.27	59.68
1975	58.02	64.04	71.82	69.08	58.89
1974	49.92	63.31	68.68	69.08	58.89
1973	51.65	64.09	71.37	71.30	58.88
1972	54.83	61.96	69.33	66.49	59.99
1971	53.66	65.81	69.64	68.40	62.40
1970	55.94	64.64	70.62	69.56	59.58
1969	53.47	64.23	67.44	69.50	59.46
1968	53.01	60.60	70.39	65.76	61.31
92 year average	53.63	63.36	68.95	66.85	59.26
Deviation from average	+ 0.52	+ 4.86	- 0.76	+ 0.42	+ 0.42

LEWISTON (CANAL)

River Statistics*

Date	TEMP. °C	pH	D.O. ppm	D.O. % Sat.	B.O.D. ppm
May					
6	10.6	6.7	11.0	98.3	1.3
13	11.0	6.6	10.8	97.7	1.5
20	13.2	6.4	10.3	97.5	1.7
27	11.8	6.6	10.6	98.1	1.4
June					
3	18.0	6.6	7.3	77.4	2.2
10	19.8	6.4	4.7	51.4	1.7
17	21.0	6.2	2.6	28.9	1.7
24	24.5	6.2	1.5	17.7	1.2
July					
1	22.2	6.2	2.3	26.8	1.5
8	21.2	6.2	2.8	31.8	1.2
15	22.2	6.4	3.1	35.9	1.1
22	22.8	6.2	4.2	48.2	1.4
29	22.6	6.2	2.7	30.9	1.7
Aug.					
5	19.0	6.4	5.7	60.6	1.8
12	20.3	6.6	8.4	91.9	2.0
19	20.3	6.7	7.5	82.0	1.4
26	22.0	6.2	3.5	39.8	1.4
Sept.					
2	20.9	6.4	3.2	35.5	2.5
9	18.3	6.4	4.6	48.6	2.1
16	18.8	6.3	5.0	53.1	2.7
23	18.3	6.4	4.0	42.2	2.4
30	15.9	6.4	5.3	52.9	2.1

*Thursday data only

PRECIPITATION

Precipitation in the Lewiston area, (also in the Pool), was above the one hundred and two (102) year average May through August. The September average was the smallest in at least nine years.

MONTHLY PRECIPITATION (inches)

Lewiston

Year	May	June	July	August	September
1976	4.68	3.99	6.20	4.91	1.65
1975	0.67	4.91	3.21	4.30	3.90
1974	5.08	4.79	3.82	3.00	3.86
1973	6.05	6.36	5.45	3.24	2.64
1972	3.59	6.13	3.82	1.90	3.97
1971	3.84	2.80	4.48	3.59	3.37
1970	2.87	2.36	3.04	2.39	3.17
1969	2.47	4.23	3.11	3.76	4.50
1968	4.02	4.20	1.94	2.02	2.29
1967	2.94	4.22	3.78	2.23	3.09
1966	3.82	5.57	2.09	3.72	3.94
102 year average	3.39	3.47	3.49	3.10	3.46
Deviation from averages	+1.29	+0.52	+2.71	+1.81	-1.81

RIVER FLOWS

River flows, recorded at Gulf Island Dam, were much above the fourty year average during May, July, August and September. August flow was more than double the average. The June flow, 3639 cfs, however, was below the long average. Daily statistics for the flows at Berlin, New Hampshire, Rumford, Livermore Falls and Gulf Island Dam, Maine, are listed at the end of Part One of this Report.

AVERAGE DAILY FLOWS (cfs)

(Gulf Island Dam)

Year	May	June	July	August	September	J.A.S. average
1976	11779	3639	3762	5673	3506	4314
1975	8551	4812	3262	2138	2590	2663
1974	17338	6461	4693	2886	3157	3578
1973	11057	7681	9326	3218	2742	5095
1972	16779	5642	4642	2960	2725	3442
1971	13308	3449	2310	2264	2250	2275
1970	11755	3378	2392	2034	2110	2179
1969	19297	5974	4102	4957	3065	4041
1968	5302	6527	4111	2360	2221	2897
1967	9684	4590	2725	2525	2377	2542
1966	8025	4664	2725	2146	2228	2366
40 year average	10582	4850	3154	2615	2721	2830
Deviation from average	+1197	-1211	+608	+3058	+785	+1484

RIVER SURFACE CONDITIONS

Persistent foam and film were present over large areas from the base of the Great Falls to the South Bridge and occasionally downstream to the Turnpike bridge. The foam usually was 'off-white' and brownish color, frequently covered the entire river area from Great Falls to the North Bridge and was the subject of numerous complaints from the public. People equate foam with serious pollution and considerable number of individuals have stated to the writer that "nothing has been done by the paper companies to abate pollution".

This season more water has been allowed to flow over the Falls and/or through the Canal by-pass Gate than during many previous summers, hence a larger volume of persistent foam in the river and canals.

On the seventeenth of August the river flow averaged 11080 cfs at Gulf Island and about one half of that passed over Great Falls in Lewiston. Foam conditions were very bad, thick brownish foam extended downstream almost to the Turnpike bridge. In the afternoon for several minutes, strong gusts of wind lifted foam from the Falls and lower Canal into the downtown area. Observers described the decent as 'snow'. The local newspaper reporters and several citizens telephoned to inquire about a possible health hazard. "Foam is pollution, pollution is <u>not</u> healthy, so what health hazard did this fall-out create", was the complaint and query of one individual.

RIVER ODOR

Objectionable river odor, Kraft and Hydrogen Sulfide were not detected in the downtown area. A letter to the editor published in the Lewiston Daily Sun, was the only complaint in the local press and it related to river odor at the Rips, upstream from the Turnpike bridge in Auburn. When present the odor there is a complex one and is the result of mixing of Little Androscoggin river water with that of the main stem and effluent from the Lewiston-Auburn sanitary waste treatment plant.

River odor in the area of Gulf Island and Deer Rips Dam was seldom observed and never serious. In June slight traces of Kraft odor were occasionally present but absent during the remainder of the season.

BLUE-GREEN ALGAE

1976

On July seventeen a sample of water taken at Mile 2.5 had a very light haze, but no visible discreet particles, which resembled samples obtained last year just before the appearance of algae.

An additional sampling program was then organised. Surface water samples were obtained at eight locations from Miles 5, 4.25, 3.5, 2.5, One, Cove A, the landing, and the two Dams. Standard B.O.D. bottles were used and the water was sampled at surface to one-half inch depth.

The algae were counted and classified as large (about 0.125" diameter), medium (1/16"), and small (about 1/32"). Some samples required dilution before the count could be made.

Blue-green suddenly developed and on Friday July 23, samples from Miles 2.5, Cove A and Mile One, contained about 40, 50 and 30 large algae, respectively. Samples from the other stations were negative, however on July 24 algae were present at Mile 3.5, about ten large per bottle. Monday July 26 algae were present at all stations from, Mile 3.5 downstream to Mile One and at Gulf Island Dam. No count was above ten large per bottle but numerous small algae were present in all samples. July 27 algae were present and sampled at Mile 4.25.

From July 27 to August 7 the daily pattern varied but in the area, from Mile 3.5 to Mile One, algae were present at most locations. The peak was reached on August 4 to 6, when some samples had to be diluted with equal volumes of water two or three times, before a count was possible. On and after August seven large algae were much reduced in numbers and were only occasionally observed. However, the medium and small algae were very numerous until the storm on August ten, when the rain and high winds made the water so rough and hazardous that sampling on that day was abandoned. The next day all stations had zero counts except Cove A, the count one lone medium algae, Mile One had a count of four. After August 28 the large blue-green algae disappeared and were not seen again. From September three to eleven small colorless algae-like individuals were occasionally present in the water samples. From September eleven to eighteen all bottle samples were clear.

Two observations require special mention. September one the writer accompanied the regular sampling crew. Only two samples contained algae, Mile 2.5 had a count of two medium algae and Mile One a count of eleven, all other samples had zero counts.

Upstream Bay Ten, which is west of Bay Nine and joined to it by a relatively narrow stretch of water, yielded samples which contained numerous small blue-green algae. Bay Thirteen (Mile Six area) also contained numerous small algae. Returning downstream in the Mile 4.75 area, near the eastern shore, were two gelatinous circular masses of blue-green algae, one about four feet diameter, the other about three feet diameter, were floating supported by large gas bubbles. Samples were taken and examined in the laboratory, The algae colonies were about three inches long and about an eighth of an inch wide. When an equal volume of river water was added, the product was a thin viscous liquid. When shaken the string-like colonies broke up into the large size blue-green individuals, similar to those seen downstream in mid-August.

Friday September seventeen, water samples from all stations were clear and algae were not present. However, five gelatinous masses of blue-green algae, similar to but slightly smaller than, those seen and examined on September one, were slowly floating downstream in the "narrows" (Mile 4.75 to Mile 4.25).

River water from Turner Center on August 16 had a hazy appearance similar to many downstream samples. The bottle was kept unstoppered and examined each day. After four days the suspended matter settled on the bottom and no change was observed until fourteen days later, when suddenly the thin layer was blue-green. When the bottle was shaken several small individual algae separated from the gelatinous layer and migrated to the surface. The last examination was made on September thirty, they were still blue-green and were all grouped together in one gelatinous mass.

CONCLUSIONS

1. Blue-green algae will grow anywhere in the Androscoggin Pool whenever conditions are favorable. They are most abundant in the sunny areas where benthal deposits are present and active.
2. Wind is a factor in their distribution, rough water forces them temporarily down one to two feet from the surface.
3. This year the blue-green algae were less numerous, smaller and did not form large nuisance areas, like those that were present in 1975. They were rapidly increasing in numbers and distribution during the first week of August, but the large flows (Max. 16970 cfs, Aug. 11) and stormy weather during the second week, destroyed so many that subsequent recovery was spasmotic. A brief resurgence of algal growth occurred August 23 to 27 and then slowly deminished.
4. All water samples from Deer Rips Dam were negative for algae except on July 27 when four medium size blue-green were present. All Lewiston Canal samples were negative.

Note: The pages which follow are copies of articles which were issued by D.E.P. and printed in the Lewiston Daily Sun.

ALGAE: SPECIAL NEWS REPORTS

June 16, 1976 Lewiston Evening Journal

The D.E.P. ALGAE: FRIEND OR FOE?

(The following article was authored by the staff of the Maine Department of Environmental Protection, and presented by The Journal in an effort to keep readers informed more fully regarding the environment, and environmental problems.)

The quality of surface waters has become a great concern to the people of Maine - a concern that includes not only the rivers and streams but also our lakes and ponds. The majority of water quality problems in Maine lakes involve algae in some way, whether it is an algae bloom in a lake or a growth of filamentous algae along the shoreline.

Algae are simple, non-vascular plants most commonly found in a water environment. Most algae are single microscopic cells, though many types form colonies of individuals which are often visible to the naked eye. Fresh-water algae may be divided into two types: planktonic and periphytic. Planktonic algae, or phytoplankton, are free-floating algae which are suspended throughout the water. There are thousands, sometimes millions of these tiny plants in every cup of lake water. Periphytic algae, or periphyton, grow attached to rocks, logs, docks, floats and rooted aquatic plants in the shallow water around the shoreline of the lake.

There are five major groups of algae found in Maine's fresh waters. These groups are called divisions and are equivalent to the phyla of the animal kingdom. They are Cyanophyta, Chlorophyta, Chrystophyta, Euglenophyta, and Pyrrophyta. All five of these divisions commonly occur in the planktonic communities of Maine lakes, but Cyanophyta, Chlorophyta, and Chrysophyta are the only divisions which include periphyton as well as phytoplankton. The Cyanophyta are called the blue-green algae because they are usually that color. Chlorophyta are green and Chrysophyta are usually yellow-green or golden-brown in color.

One class of Chrysophyta, diatoms, are very important in Maine lakes since they often account for a majority of the phytoplankton community. Diatoms are characterized by glass-like cell walls which are divided into over-lapping halves. The Euglenophyta and Pyrrophyta are generally less abundant in the phytoplankton than the other divisions. They are single celled organisms which propel themselves through the water with whiplike structures called flagellae. Some species of the Chlorophyta and Chrysophyta also have flagellae.

Base of Food Chain

Algae manufacture their own food, like most other plants, by a process called photosynthesis. In photosynthesis, the algae absorb dissolved carbon dioxide and water, and, using light energy from the sun, they convert these substances to simple sugars which they use for growth and respiration. Oxygen is a byproduct of this process and is released into the water as dissolved oxygen.

Algae cells contain specialized compounds called pigments which act as light absorbers, energy traps, reaction sites, and catalysts in the photosynthetic process. Chlorophylls, carotenes, and xanthophylls are the most abundant types of pigments. They are often localized within the algae cell in specialized bodies called chromatophores. These pigments give algae their color.

Since they produce their own food, algae are the base of the lake's food chain and are therefore referred to as primary producers. They are "grazed" by the zooplankton (small animals suspended in the water) and by insects living in the shallows. Zooplankton and insects serve as food for minnows and other small fish which are in turn eaten by larger fish. Hence, the total fish population of a lake is indirectly limited by the density and composition of the algae community.

Limits to Growth

If fish are limited by the algae community, what determines the amount of algae produced in a lake? Basically, the growth of algae depends on the intensity and duration of sunlight reaching the algae, the temperature of the water, and the concentrations of substances called nutrients in the water. Nutrients include the carbon and oxygen necessary for photosynthesis, along with such elements as nitrogen, phosphorus, potassium, magnesium, calcium, and sulfur. These elements are needed in relatively high concentrations and are referred to as "macronutrients." Several other elements are required in much lower concentrations and are called "micronutrients" or "trace elements". Nutrients combine with the sugars derived from photosynthesis, cell construction, cell maintenance, and reproduction.

Nutrient concentrations usually determine, in absolute terms, the amount of phytoplankton produced in the lake. Lakes with high available nutrient concentrations are capable of producing more algae than lakes with low nutrient concentrations, if all other factors are equal. Lakes with high nutrient concentrations are called eutrophic while lakes with low nutrient concentrations are referred to as oligotrophic.

Phosphorus is the nutrient which most often limits algal growth in Maine lakes, not because it is any more important to the algae cell than the other nutrients but because it is often the nutrient in least abundance relative to the cell's requirements. This idea is supported by research and monitoring done on dozens of Maine lakes and also by extensive studies elsewhere in the United States and Canada.

Helping safeguard Maine's environment is everyone's responsibility. If you want to report a possible violation, seek information about environmental laws, or obtain help in applying for state permits or licenses, call Maine's Citizens Environmental Assistance Service. The toll-free number from any telephone in Maine is 1-800-452-1942. In the Augusta area, one may call 289-2691.

NEXT ISSUE: "ALGAE BLOOMS"

ALGAE: SPECIAL NEWS REPORTS

June 23, 1976 Lewiston Evening Journal

ALGAE BLOOMS ARE VERY OBNOXIOUS

(Editor's Note - The following is another special article written by a staff member of the Department of Environmental Protection of the State of Maine. Today's article was written by Staff Biologist Jeffery Dennis.)

"A lake is the landscape's most beautiful and expressive feature. It is earth's eye: looking into which the beholder measures the depth of his own nature."

Henry David Thoreau
Walden

A lake covered with the green scum of an algae bloom can hardly be beautiful. For this and many other reasons, cottage owners and lake users in Maine dread algae blooms as the worst calamity which their lake might suffer. Fortunately, algae blooms occur only on a relatively small number of Maine lakes, but when they do they can be very obnoxious.

The previous article in this series discussed different types of algae which occur in Maine's lakes and the fact that abundance of algae in lake water is usually dependant on concentration of nutrients, especially phosphorus, in the water. Light intensity is also an important factor controlling the amount of algae in water.

Phytoplankton

Algae blooms occur in lakes with very high nutrient concentrations. The phytoplankton (planktonic algae suspended in the water) become dominated by whichever species of algae can most efficiently use the particular combination of nutrients available. This dominant algae becomes so abundant that water transparency is reduced to three feet or less. The water looks green or blue-green (sometimes olive or black when the algae are dying) and may have a soupy appearance. The algae may be concentrated by wind action into windrows or along the downwind shore of the lake.

Most of the blooms in Maine lakes are either diatom blooms or blue-green algae blooms. Diatoms are members of the division Chrysophyta which are covered by glass-like shells made of silica. Diatom blooms usually occur in late spring or early summer. They are triggered when a high level of nutrients, especially phosphorus and silica, enters the euphotic zone (zone of significant light penetration). This happens after spring turnover, when water from the bottom of the lake is mixed with water from the top.

Diatom blooms are less objectionable than blue-green blooms. They turn the water a bright green and cause a severe decline in water transparency, but do not create the scums and odors associated with blue-green algae blooms. They often occur without even being noticed by lake users.

Cyanophyta or blue-green algae blooms create a much greater problem for lake users than do diatom blooms. Many blue-green algae have gas vacuoles which cause them to stay suspended near the surface. This makes them more subject to concentration by wind action and to formation of scums on the surface. This scum may be blown into the shallows and onto exposed rocks, making the shoreline appear to be covered with blue-green paint.

Very Unpleasant

When blue-green algae die and decompose, the resulting odor can be very unpleasant. Problems of odor and appearance are magnified since blue-green blooms usually occur in July, August, and September, when recreational use of the lake is at its peak.

Several different blue-green algae are likely to bloom in Maine lakes, given the right conditions. The most common of these is Anabaena, which forms chains of bead-like cells. Recent summer blooms in Annabessacook and Cobbosseecontee lakes in Haley Pond in Rangeley were composed of Anabaena. In bloom concentrations, Anabaena filaments are visible to the naked eye if a sample of the water is held up to the light. Aphanizomenon has been the blooming algae in Sebasticook Lake in recent summers and Gloeotrichiia has caused problems in Pennesseewassee (Norway) Lake.

In addition to the obvious aesthetic problems, algae blooms can have detrimental effects on the lake ecosystem. Some lakes thermally stratify in the summer, meaning they develop layers of water at different temperatures. No mixing of aerated surface (epilimnion) with the colder, bottom water (hypolimnion) occurs in a stratified lake, and therefore no additional dissolved oxygen enters the bottom water.

When algae in the surface water die, they settle out into the hypolimnion, where they are decomposed by bacteria. Bacteria consume oxygen, thus depleting the limited supply of dissolved oxygen in the bottom water. If algal production is high, as is the case during algal booms, the dissolved oxygen may be reduced to very low levels. This can cause suffocation of cold-water fish such as togue and salmon, which require high oxygen levels in the colder water of the hypolimnion.

Unpleasant Taste

If an algae bloom occurs in a public water supply, it may give the water an unpleasant taste or odor which is difficult to remove. It is a common misconception that algal blooms are a health hazard. Some species of blue-greens release toxins, but laboratory tests have shown that only consumption of large amounts of these toxins can produce harmful effects in mammals. There have been no reports of human disease or poisoning resulting from natural algae blooms.

Algal blooms are often a natural phenomenon. Many small lakes have nutrient concentrations which are naturally high enough to support algal blooms. Nubble Pond in Raymond is such a lake. All too often, however, human influences are either directly or indirectly the cause of algal problems. Municipal sewage or industrial wastes discharged into a lake or a lake's drainage system can add sufficient nutrients to cause algal blooms, even in lakes with relatively low natural concentrations. Two prime examples of this exist in Maine. Annabessacook Lake and Sebasticook Lake have both been subjected to municipal and industrial discharges which have resulted in severe blue-green blooms.

Indirect discharges resulting from improper land use in a lake's drainage can also contribute significant quantities of nutrients. Agricultural practices such as spreading manure on sloping or frozen fields, and pasturing of cattle on lake tributaries, have cause algal blooms in some waters such as Lovejoy Pond in Albion. Excessive erosion resulting from poor soil management has hastened the euthrophication of Long Lake in St. Agatha.

Extensive cottage development can also result in large nutrient addition to a lake system if septic tanks are not functioning properly or are located in unsuitable soils or flood plains. North Pond in Smithfield and Togus Pond in Augusta have experienced algae blooms as a result of their densely and improperly developed shorelines.

NEXT TIME: WHAT CAN BE DONE ABOUT ALGAE BLOOMS?

ALGAE: SPECIAL NEWS REPORTS

June 30, 1976 Lewiston Evening Journal

IT TURNS THE WATER GREEN

ALGAE BLOOMS: WHAT CAN BE DONE?

(The following article was written by a staff biologist of the Maine Department of Environmental Protection).

By JEFFERY DENNIS

An algal bloom is a dense growth of planktonic algae. It turns lake water green or blue-green and reduces water transparency to three feet or less. Fortunately, algae blooms occur on only a few Maine lakes, but when they do they are very disturbing to most lake users.

Algae blooms occur because of excessive concentrations of nutrients, especially phosphorus, in the water. High nutrient concentrations may exist naturally, but are often the result of human practices. They can be caused by industrial discharges, poor agricultural practices, or faulty septic systems.

What can be done about algae blooms? The first step is to determine what is causing the problem.

If a lake is naturally rich enough in nutrients to support a bloom there is little that can or should be done to prevent it. However, if the nutrients causing the problem are a result of human activities, the problem may be solved by eliminating the source of nutrients. This can be accomplished by eliminating or diverting waste discharges, correcting faulty septic systems, or improving land management practices.

If artificial sources of nutrients are removed, there is a good chance a polluted lake will recover.

Brettuns

Brettuns Pond in Livermore provides an excellent example of lake recovery. In the Summer of 1973, a poultry operation in the pond's drainage had several problems with manure collection, storage, and disposal, which resulted in a very large input of nutrients into the lake. Brettuns Pond had a history of relatively good water quality and no algal blooms before this discharge.

By midSummer, the lake had a very dense algae bloom which continued through to mid-September. The Department of Environmental Protection investigated the problem, determined that the egg farm was the cause, and requested that the farm clean up its wastes. Once the problem was recognized, the farm's management cooperated in eliminating the discharge.

The following summer, the pond improved considerably, and there were no algal blooms.

The Brettuns Pond problem was not typical because the discharge had only lasted one year. Nutrients had not had a chance to build up in the lake and its sediments. In a lake like Annabessacook in Kennebec County or Sebasticook near Newport, where nutrient inputs have been recurring repeatedly for a long period of time, recovery may take many years.

Algicides such as cooper sulfate are often proposed as the solution to algal problems, but there are three major drawbacks to the use of these chemicals.

Cosmetic

Algicides do not solve the problem. They are merely a temporary cosmetic treatment of the symptoms of nutrient enrichment - and a fairly expensive treatment at that. Another, and perhaps more important, problem with broad spectrum algicides is that repeated applications can have toxic effects on other aquatic organisms in the lake and its sediments. Thus, algicides can disrupt the entire lake community.

The third drawback to the use of algicides is that resistant strains of algae may develop as a result of repeated treatment. Copper treatments of algal blooms in Sebasticook Lake caused a change in the blooming algae from Anabaena to a species of Aphanazomenon which is not affected by copper, and forms even more obnoxious blooms.

For all three reasons, use of algicides to control algal blooms is discouraged by the Department of Environmental Protection. Rather, the DEP works with lake area residents and local governments to seek elimination of unnatural nutrient levels in lakes.

July 2, 1976 Lewiston Daily Sun

Source of Algae Bloom Sought
by DEP at Pleasant Pond

TURNER - Pleasant Pond here is being sample tested by DEP in an attempt to determine the nutrient sources which are causing an algae bloom, according to DEP biologist Barry Mower.

Mower told the Sun this week that the DEP first became aware last summer of the algae problem in this previously good quality water when they were called to the west shore property of Robert Boothby who reported a filamentous algae in that area. At that time DEP biologists noticed a partcial bloom.

Though the secchi disc (visability) was good at 12 feet, a search revealed a bluish-green algae mass and sample testing began. Boothby told the biologists that a bloom had occurred the year before, also.

At one time the bloom was "pretty much all over the pond" according to Mower who said that testing is continuing and there is a possibility that regular sampling will be undertaken by a lay monitoring program which has been helpful in many areas.

Mower said that biologists have walked the shore lines and tributaries, discovering some badly eroded stream channels from the hills above the shore line. The team also noted some septic system irregularities but not a lot. Drainage conditions eliminate possibility of pollution by the nearby poultry farms, according to Mower. The DEP biologist said the source of pollution has not been positively identified but that he believes the farming activity in the water shed is contributory.

Egg Farms

The biologist said further that he is convinced that the egg farms in the areas are not pollutant, due to the existing drainage conditions. He said that indentification of the nutrients is necessary, however, before the DEP can initiate a program for elimination of the problem.

Mower said that manure storage guidelines are issued for farming actibity in a water shed but there are not statutes. The DEP is therefore helpless to regulate those activities and have to rely on the good intentions of the offender for effective treatment of source pollution. He further stated that legislation will be introduced, hopefully this year.

Jeff Dennis, a biologist with DEP who has written papers on the subject, told the Sun that 35 lakes are undergoing an extensive sample testing under a USGF Division of Water Resources program, initiated in 1974. Lakes for testing were chosen through the recommendations of fish and game biologists seeking background information in areas which they consider potential problems.

Brettuns Pond is one of those chosen because of its earlier condition and Dennis said that samples taken last week show that the water has returned to its normal state and has a secchi disc of 16 feet.

Long Pond, a short distance north on Route 4 is another being sample tested and is found to be without algae problems. The pond is shallow, only 17 feet at its deepest spot, according to the biologists, and its natural state is one of productive activity.

The DEP staff biologist explains algae blooms and treatment in a well prepared paper providing good information for a lake pollution concerned public. Brettuns Pond is cited in the paper as an "excellent example of lake recovery".

Dennis says of Brettuns Pond, "In the summer of 1973 a poultry operation in the pond's drainage had several problems with manure collection, storage and disposal, which resulted in a very large input of nutrients into the lake. Brettuns Pond had a history of relatively good water quality and no algal blooms before this discharge.

"By midsummer the lake had a very dense algal bloom which continued through to mid-September. The Department of Environmental Protection investigated the problem determined that the egg farm was the cause, and requested that the farm clean up its wastes. Once the problem was recognized, the farm's management cooperated fully in eliminating the discharge. The following summer the pond improved considerably and there were no algal blooms."

Dennis goes on to say that the Brettuns Pond situation is not typical because one discharge had lasted only a year. In other problem areas such as Annabessacook, and Sebasticook, where nutrient inputs have been recurring repeatedly for a long period of time, recovery of the lake may take many years, Dennis says. In the case of the Livermore pond, nutrients had not had a chance to build up in the lake and its sediments, Dennis said.

The Brettuns Pond Association is an active organization of camp owners and Livermore residents who intend to keep their sparkling waters pollution free. It is a cold, spring fed body of water . . . lined with cottages, many of which have become year-round residences. The quick recognition of a problem and prompt report to the DEP is no doubt the factors which saved the waters from continuing pollution. The cooperation of the polluters . . . the egg farm and some cottage residents who were emptying sewage into the lake . . . is also a major factor in the recovery of Brettuns Pond.

Algal blooms are quickly recognized on a body of water. The surface becomes a light greenish color near the shoreline, spreading outward according to the amount of phosperous in the water. When this condition is spotted, it can be considered pollution, and prompt action is indicated.

Glenda Richards, secretary of the Pond Association, had nothing but praise for the DEP whose quick response to the situation led to the successful recovery.

Dennis, in his article, opposes the use of algicides, stating that they are merely a temporary cosmetic treatment of the symptoms of nutrient enrichment, and an expensive method at that.

ALGAE

1. Blue green algae are very small primative aquatic plants, they contain chlorophyl and their carbon requirements are obtained from carbon dioxide in the water. The sources of the carbon dioxide are, defusion from the air and from decaying organic matter. Nutrients are necessary especially nitrogen and phosphorus compounds and other trace substances. Adequate light energy and favorable water temperature (18-28°C) are necessary for growth and to sustain life.

2. Blue green algae occasionally have been observed in the Androscoggin Pool for more than thirty years but prior to 1975 they were recorded as usually present in very small colonies and always attached to moist floating objects, logs, small branches and floating solids. Biologists refer to them as periphytic algae.

3. Late in July and to mid-September 1975 blue green algae began to 'bloom' in very large numbers as free floaters. (Planktonic). They were present in the Pool from Mile zero (Gulf Island Dam) to upstream Mile four. They are subject to wave motion and were very numerous in certain areas where the contour of shore line and direction of the wind favored aggregation. Blue green algae eventually passed downstream to Deer Rips but passage through the turbines at the two Dams destroyed large numbers. They were occasionally observed in the Lewiston Canals but were not reported in the river south of the canal outfalls.

The algae appeared in mid-July 1976 in the Mile 3.5 area and at this date (8/5/76) are now present at Gulf Island Dam to Mile 4.25. They are smaller and less numerous than last year and have not formed large surface 'blooms' but probably will do so later in August.

4. Pros & Cons. Algae are plants and their metabolic processes absorb carbon dioxide and excrete oxygen. The liberated oxygen dissolves in the water and is available for animal marine life expecially microbial aerogens. During August 1975 the algal oxygen contribution was appreciable.

Herbicides have been employed to control and eliminate blue green algae. Copper sulfate is very effective in concentrations of about one ppm. Recently certain organic compounds have been used as algal herbicides. However State of Maine authorities have opposed the use of any herbicide because of possible harmful effect on fish and other marine life. They also emphasize the fact that the elimination is temporary.

Experts in this field state the only satisfactory solution to the blue green algal problem is to eliminate the source of the nutrients. A few large area 'blooms' have been traced to the discharge of dairy and chicken wastes and to fertilizer leachates. When the sources were stopped the problem eventually disappeared.

5. The life cycle of blue green algae is relatively short, it may extend from a few days to a few weeks. After death they decay and in stagnant or very slow moving water objectionable odors may be present. However, in the Androscoggin Pool in 1975 objectionable odor was not detected, probably due to downstream movement and volume of the water prevented a large accumulation of decaying algae.

DATA RECAPITULATION

NORTH TURNER - DEER RIPS DAM

1973, 1974, 1975, 1976

Monthly averages for the four seasons 1973 to 1976, are recorded for five sampling stations in the North Turner-Deer Rips sectos. Analyses and Tests were made six days each week at three locations, North Turner, Turner Center and Deer Rips Dam, and five days each week at Miles 4.25 and 2.5.

1973	June 4-29 July 30-Sept. 1	July 2-28 Sept. 3-15
1974	June 3-28 July 29-Aug. 31	July 1-27 Sept. 2-14
1975	June 2-28 July 28-Aug. 30	June 30-July 26 Sept. 1-12
1976	May 31-June 26 July 26-Aug. 28	June 28-July 24 Aug. 30-Sept. 11

Part One of this report contains similar statistical comparisons for all stations Berlin, New Hampshire to Livermore Falls, Maine.

ANDROSCOGGIN RIVER

YEAR June	STATION	FLOW cfs	TEMP. °C	D.O. ppm	D.O. lbs/day	B.O.D. ppm	B.O.D. lbs/day
1973	NTB	7111	18.5	7.7	290560	3.8	149670
1974	(6 day)	5729	18.5	7.9	253570	2.5	72170
1975		4283	18.3	7.5	183680	2.4	53820
1976		3449	21.0	6.7	124790	2.6	48420
1973	TCB		18.8	6.8	281700	3.2	123980
1974	(6 day)	6317	18.7	7.1	256500	2.1	75770
1975		4719	18.6	6.6	180980	2.0	46200
1976		3665	21.5	5.5	111530	2.1	39840
1973*	MILE	7374	19.1	6.0	257320	3.4	134100
1974*	4.25	6320	19.1	6.2	227300	2.2	76530
1975*		4903	18.4	5.6	168300	2.1	53470
1976*		3682	22.1	4.3	87490	2.6	49100
1973*	MILE	7374	19.2	5.3	230170	3.6	137130
1974*	2.5	6320	19.2	5.7	208280	2.3	78530
1975*		4903	18.5	4.9	148780	2.1	53070
1976*		3682	22.1	3.4	70870	2.4	48160
1973	DEER RIPS	7481	18.6	5.7	245400	2.8	110120
1974	DAM	6320	18.6	6.2	229810	1.9	67710
1975	(6 day)	4720	18.0	5.0	141420	1.6	38580
1976		3666	21.0	3.2	70170	1.7	33250

YEAR July	STATION	FLOW cfs	TEMP. °C	D.O. ppm	D.O. lbs/day	B.O.D. ppm	B.O.D. lbs/day
1973	NTB	8725	21.8	6.7	364700	3.2	113050
1974	(6 day)	4595	21.1	6.8	174570	2.6	62000
1975		3147	23.6	6.0	105150	2.3	35650
1976		3430	22.2	6.6	122050	2.1	39050
1973	TCB	9245	22.1	5.7	354330	2.5	104720
1974	(6 day)	4844	21.8	5.2	146650	2.3	57600
1975		3378	24.1	4.4	87660	1.9	34100
1976		3697	22.6	5.5	110960	1.7	33240
1973*	MILE	9417	22.4	4.7	325190	2.7	110130
1974*	4.25	4813	22.1	3.8	110260	2.4	57680
1975*		3432	24.3	2.9	63230	1.8	32680
1976*		3709	23.3	4.2	83540	1.8	35560
1973*	MILE	9417	22.4	3.6	295060	3.4	132250
1974*	2.5	4813	22.5	2.8	83550	2.3	59730
1975*		3432	24.6	1.9	39920	1.5	26550
1976*		3709	22.8	3.1	60030	1.4	28350
1973	DEER RIPS	9246	22.5	3.6	325230	2.8	115140
1974	DAM	4845	22.3	2.6	84950	2.0	48580
1975	(6 day)	3379	24.0	1.8	38040	1.3	23320
1976		3698	23.1	2.2	41030	1.2	24140

*Five day week

ANDROSCOGGIN RIVER

YEAR August	STATION	FLOW cfs	TEMP. °C	D.O. ppm	D.O. lbs/day	B.O.D. ppm	B.O.D. lbs/day
1973	NTB	2952	23.3	4.5	72310	5.0	77850
1974	(6 day)	2785	21.9	5.9	88090	2.9	43340
1975		2103	22.6	5.8	64680	2.7	30520
1976		5108	20.6	7.0	200500	2.3	69510
1973	TCB	3171	23.8	2.5	45270	4.0	67280
1974	(6 day)	2902	22.5	4.1	65100	2.6	41670
1975		2175	23.3	3.8	43940	2.0	23340
1976		5634	21.0	6.2	198980	1.8	59630
1973*	MILE	3172	24.3	1.0	20550	3.7	63870
1974*	4.25	2907	23.3	2.0	33260	2.5	40310
1975*		2177	23.8	2.0	23030	1.7	19670
1976*		5673	21.4	5.1	168290	1.7	54350
1973*	MILE	3172	24.7	0.2	3920	5.6	94620
1974*	2.5	2907	23.6	0.5	8150	2.3	35350
1975*		2177	24.2	1.0	12230	1.4	16010
1976*		5673	21.9	4.3	141500	1.6	51220
1973	DEER RIPS	3172	24.5	0.1	1560	5.0	83410
1974	DAM	2903	23.4	0.5	8250	2.0	30790
1975	(6 day)	2176	24.0	1.7	18510	1.1	13110
1976		5635	21.7	4.5	160900	1.3	42960

YEAR September	STATION	FLOW cfs	TEMP. °C	D.O. ppm	D.O. lbs/day	B.O.D. ppm	B.O.D. lbs/day
1973	NTB	2646	19.9	5.7	80040	5.8	81220
1974	(6 day)	3254	18.7	7.3	130460	2.4	43490
1975		2145	17.8	7.0	80880	2.5	29050
1976		3404	18.3	7.5	137270	2.2	40890
1973	TCB	3036	20.8	3.5	54330	4.3	42660
1974	(6 day)	3235	18.9	6.4	121160	2.1	38900
1975		2194	18.4	6.0	71430	2.0	23280
1976		3612	18.6	6.6	126870	1.8	35280
1973*	MILE	3037	21.9	1.8	27320	3.6	52380
1974*	4.25*	3279	19.3	5.5	98730	1.8	32410
1975*		2138	19.0	4.8	56290	1.9	22710
1976*		3634	19.0	5.7	108740	1.7	33770
1973*	MILE	3037	22.6	0.4	5860	4.1	62560
1974*	2.5	3279	19.7	3.9	69810	1.8	31030
1975*		2138	19.6	3.5	41150	1.4	16250
1976*		3634	20.1	3.9	74960	1.4	27330
1973	DEER RIPS	3037	22.2	0.1	1970	3.7	57140
1974	DAM	3236	19.5	3.0	53520	1.3	23700
1975	(6 day)	2195	19.4	3.4	39280	1.2	13770
1976		3613	20.0	3.6	67770	1.3	23550